REMARKS

Claims 9-22 are pending in this application. By this Amendment, claims 9 and 16 are amended. Support for the amendments to claims 9 and 16 can be found in the specification as originally filed, for example at page 7, lines 5-19. Thus, no new matter is added by these amendments.

I. Rejections of Claims 9, 11-16 and 18-22

The Office Action rejects claims 9, 11-16 and 18-22 under 35 U.S.C. §103(a) over U.S. Patent 6,080,970 to Yoshida et al. or U.S. Patent 5,904,872 to Arami et al. in view of U.S. Patent 5,877,473 to Koontz. Applicants respectfully traverse this rejection.

Claim 9 sets forth a "ceramic heater used in an industrial field of semiconductors, comprising: a disk-shaped ceramic substrate; and a heat-generation pattern disposed on a surface of said disk-shaped ceramic substrate, wherein said disk-shaped ceramic substrate has a diameter of 200 mm or more and said disk-shaped ceramic substrate is made of at least one selected from a group essentially consisting of nitride ceramics and carbide ceramics; and said heat-generation pattern has a bending portion which describes an arc having a curvature radius within a range of 0.1 mm to 20 mm, so that a pattern width is constant; and a semiconductor wafer is heated on a surface opposite to the surface of the ceramic substrate forming the heat-generating body." Claim 16 sets forth a "ceramic heater used in an industrial field of semiconductors, comprising: a disk-shaped ceramic substrate; and a heat-generation pattern disposed within said disk-shaped ceramic substrate, wherein said disk-shaped ceramic substrate has a diameter of 200 mm or more and said disk-shaped ceramic substrate is made of at least one selected from a group essentially consisting of nitride ceramics and carbide ceramics; and said heat-generation pattern has a bending portion which describes an arc having a curvature radius within a range of 0.1 mm to 20 mm, so that a pattern width is constant." Claims 11-15 and 18-22 depend, directly or indirectly, from claims 9 and 16.

According to claims 9 and 16, heat-generation patterns are formed on the surface of a ceramic substrate having a high thermal conductivity, and the wafer, heated on a surface opposite to the surface of the substrate, is provided with a pattern. Because the thermal conductivity of the ceramic substrate is high, the temperature rising time is short and the temperature rising rate is fast. However, because the thermal conductivity is high, temperature distribution on the wafer surface opposite the patterned substrate surface is caused by any scattering of temperature present in the heat-generation pattern.

In conventional systems, the bending portions of the heat-generation pattern have a lower resistance value, due to scattering, and the heat-generation quantity is lowered. That is, the width of the bending portion is greater than the width of the remainder of the pattern, causing the temperature of the heating face just above the bending portion to be lower than other areas of the pattern. This can be seen from Comparative Example 1, which does not describe an arc and results in a 10°C temperature difference between the portion of the pattern just above the bending portion and the remainder of the heating face, and Reference Example 1 in the instant specification, which does not describe an arc and results in a 8°C temperature difference between the portion of the pattern just above the bending portion and the remainder of the heating face.

Claims 9 and 16, however, set forth the limitation that the "bending portion ... describes an arc having a curvature radius within a range of 0.1 mm to 20 mm, so that a pattern width is constant." Because the arc provides a constant pattern width, lowering of the resistance value of the bending portion of the pattern is suppressed, and the temperature scattering of the heat-generation pattern is prevented. Thus, the uniformity of the temperature of the heating face is improved. This is demonstrated by Examples 1-4 of the instant specification, which use AlN as the ceramic substrate and describe a bending portion having a radius of curvature of 0.1 to 20 μm, with constant widths. These result in temperature

differences of only 1-5°C between the portion of the pattern just above the bending portion and the remainder of the heating face.

Yoshida and Arami are cited in the alternative for allegedly teaching a ceramic heater including a disk-shaped ceramic substrate, which may be aluminum nitride, with a heat-generating pattern, having a combination of spiral and bending pattern, disposed on the surface of the ceramic substrate, and a semiconductor wafer heated on the surface opposite to the surface of the ceramic substrate. Arami is further cited for the teaching that the disk-shaped ceramic substrate has a diameter of eight inches or more, in order to accommodate a wafer with a diameter of eight inches.

However, as admitted by the Office Action, neither Yoshida nor Arami disclose or suggest that the bending portion of the heat-generating pattern describes an arc having a curvature radius within a range of 0.1 mm to 20 mm. In addition, neither Yoshida nor Arami disclose or suggest that the bending portion of the heat-generating pattern describes an arc having a curvature radius within a range of 0.1 mm to 20 mm, so that the pattern width is constant, as required by claims 9 and 16.

Further, the width of the arc portions of the wafer heating apparatus of Yoshida is wider than the width of the straight portions (Yoshida, claim 1), which corresponds to Comparative Examples 1-4 and Figure 6 of the instant specification. Comparative Examples 1-4 result in temperature differences of 10-15°C between the portion of the pattern just above the bending portion and the remainder of the heating face. See Specification, Table 1. Thus, Yoshida does not disclose or suggest that the bending portion of the heat-generating pattern describes an arc having a curvature radius within a range of 0.1 mm to 20 mm, so that the pattern width is constant, as required by claims 9 and 16.

Still further, Arami discloses a heater in which the heat-generation body is formed on the rear surface of a silica heating plate. However, silica has a low thermal conductivity, and

Arami teaches away from the use of AlN or alumina as a substrate because "the heating plate tends to form particles, so that contamination may occur in a processing vessel or on a semiconductor wafer." Arami, col. 1, lines 33-36.

Thus, neither Yoshida nor Arami, alone or in combination, would have rendered claims 9 and 16, or their dependent claims, obvious. Koontz fails to remedy the shortcomings of Yoshida and Arami.

Koontz is cited for allegedly disclosing a heating pattern having a bending portion with a curvature radius within the claimed range. However, Koontz teaches preventing hot and cold spots by providing radiused ends of about 3.5 cm (350 mm), which is well outside the claimed range of 0.1 mm to 20 mm.

Further, Koontz discloses vehicle windshields having heating elements. See Koontz, col. 2, lines 44-56. The windshields have an outer glass sheet 22 and an inner glass sheet 24 joined by an interlayer 26 made of a sheet of polyvinylbutyral. See Fig. 2 and col. 3, lines 59-64. A heating element 42 is located between the outer glass sheet 22 and the polyvinylbutyral interlayer 26. See Fig. 2 and col. 4, lines 48-55. One side of the heating element 42 is in contact with the outer glass sheet 22, and the other side of the heating element 42 is in contact with the polyvinylbutyral interlayer 26. Thus, the heating element 42 is not formed within a substrate. Koontz discloses a heating element 44 that includes a substrate 52 and a conducting member 54. See Fig. 3 and col. 6, lines 32-36. The conducting member 54 is on the surface of the substrate 52, and is not inside the substrate 52. Therefore, the conducting member 54 is not formed within the substrate 52. Nowhere does Koontz disclose or suggest a heating element or a conducting member that is formed within a substrate. Nowhere does Koontz disclose or suggest a semiconductor wafer that is heated on the surface opposite to the surface of a ceramic substrate forming a heat-generating body.

Thus, unlike claims 9 and 16, Yoshida, Arami and Koontz, alone or in combination, do not disclose or suggest a ceramic heater including a disk-shaped ceramic substrate with a heat-generation pattern on a surface of the disk-shaped ceramic substrate, in which the disk-shaped ceramic substrate has a diameter of 200 mm or more and is made of nitride ceramics and/or carbide ceramics, and the heat-generation pattern has a bending portion which describes an arc having a curvature radius within a range of 0.1 mm to 20 mm, so that a pattern width is constant; and a semiconductor wafer is heated on a surface opposite to the surface of the ceramic substrate forming the heat-generating body.

Applicants respectfully submit that claims 9 and 16, and their dependent claims 11-15 and 18-22, are patentable over Yoshida or Arami in view of Koontz. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

II. Rejections of Claims 10 and 17

The Office Action rejects claims 10 and 17 under 35 U.S.C. §103(a) over U.S. Patent 6,080,970 to Yoshida et al. or U.S. Patent 5,904,872 to Arami et al. in view of U.S. Patent 5,877,473 to Koontz, as applied above, and further in view of U.S. Patent 6,072,162 to Ito et al. or U.S. Patent 6,084,215 to Furuya et al. Applicants respectfully traverse this rejection.

Claims 10 and 17 depend from claims 9 and 16, respectively, and set forth the further limitation that "through-holes for inserting support pins are formed on the ceramic substrate."

For at least the same reasons set forth above with respect to claims 9, 11-16 and 18-22, claims 10 and 17 are patentable over Yoshida or Arami in view of Koontz. That is, no combination of these references teaches or suggests a ceramic heater having a heat-generating pattern in which "has a bending portion which describes an arc having a curvature radius within a range of 0.1 mm to 20 mm, so that a pattern width is constant." In addition, the Office Action admits that Yoshida or Arami in view of Koontz does not disclose or suggest a

ceramic heater having through-holes for inserting supporting pins. Neither Ito nor Furuya remedies the shortcomings of Yoshida, Arami and Koontz.

Ito and Furuya are cited for allegedly disclosing a wafer supporting heater having a plurality of through-holes for inserting supporting pins to support a wafer. However, regardless of their actual teachings, neither of these references disclose or suggest a ceramic heater having a heat-generating pattern which "has a bending portion which describes an arc having a curvature radius within a range of 0.1 mm to 20 mm, so that a pattern width is constant."

Thus, Applicants respectfully submit that claims 10 and 17 are patentable over Yoshida or Arami in view of Koontz and further in view of Ito or Furuya. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

III. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 9-22 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

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